

# NASA TECH BRIEF



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## Improved Gyro-Flotation (Damping) Fluids

### The problem:

Develop an improved stabilizer fluid for floated gyros. Floated gyros, depend upon high density (2.38 gm/cc), medium viscosity (900 cs), and gyro-flotation fluids to support the float, minimize the friction in the float bearings and damp the movement of the float. The sensitivity of a gyro can be increased with a fluid of higher density which could support a heavier float.

### The solution:

Synthesize a metal-stabilized halophosphazene compound with a density of 3 gm/cc at 137°F.

### How it's done:

The process used in this study was as follows: 123 gm  $\text{SbCl}_3$ , 186 gm  $\text{PCl}_3$ , 259 gm  $\text{Br}_2$ , 220 gm  $\text{NH}_4\text{Br}$  and 300 cc 1,2,4-trichlorobenzene (TCB) were brought to 145° in an oil bath and maintained at this temperature until the evolution of hydrogen halides was complete as measured by trapping in a caustic trap and back titration. The reaction was filtered hot and washed with hot TCB. The filtrate was then distilled in vacuo until the color indicated that it was bromine-free. Two phases form: a lower polymer phase, and an upper solvent phase. The solvent was siphoned off and the polymer washed free of cyclic phosphazene by-products with two 150 cc portions of  $\text{CCl}_4$ . The  $\text{CCl}_4$  was in turn siphoned off. The lower polymer

phase was then brought to 150°C and 30  $\mu$  pressure and held until it was solvent free. The yield was 189 gm of a dark, viscous, oil,  $d_{20}^{20} - 2.93$  gm/cc 58° - 700 cs. The oil had the composition  $\text{P}_3\text{N}_2\text{Br}_8\text{Cl}_3\text{Sb}$ . The molecular weight determined cryoscopically in nitrobenzene was 1180.

### Notes:

1. This disclosure should be of interest to manufacturers of precision instruments, and the chemical industry.
2. Documentation is available from:  
Clearinghouse for Federal Scientific  
and Technical Information  
Springfield, Virginia 22151  
Price \$3.00  
Reference: TSP69-10360

### Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Sanford S. Jacobs of  
M and T Chemicals, Inc.  
subcontractor to MIT  
under contract to  
Manned Spacecraft Center  
(MSC-13217)

Category 03